



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/502,232	07/22/2004	Eal H. Lee	50820030.66599-US02	1509

44866 7590 10/09/2007  
WELLS ST. JOHN P.S.  
601 WEST FIRST AVE  
SUITE 1300  
SPOKANE, WA 99201

EXAMINER
----------

CHAUDHARI, CHANDRA P

ART UNIT	PAPER NUMBER
----------	--------------

2891

MAIL DATE	DELIVERY MODE
-----------	---------------

10/09/2007

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

Application No.

10/502,232

Applicant(s)

EAL H. LEE

Examiner

Chandra Chaudhari

Art Unit

2891

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-76 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-76 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 7-22-04 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☐ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_.
- ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_.
- ☐ Notice of Informal Patent Application
- ☐ Other: \_\_\_\_.

Art Unit: 2891

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 6, 35-36, 39 are rejected under 35 U.S.C. 102(b) as being anticipated by the Sakamoto article.

Sakamoto (article, see especially pages 169, 171) discloses the claimed invention having a thin film of Zr, Ti, and optionally Ti, a portion of the thin film having a non-columnar grain structure.

Claims 1, 6, 8, 35-41 are rejected under 35 U.S.C. 102(e) as being anticipated by Hu – US 6,204,171.

Hu (especially col. 6, line 42 to col. 10, line 57) discloses the claimed invention with a nitride of a diffusion barrier, having at least a portion having a non-columnar grain structure. Hu states the nitrogen content can be adjusted.

Claims 24, 27 are rejected under 35 U.S.C. 102(b) as being anticipated by Wolf.

Wolf (especially pages 190, 193) discloses the claimed invention with uniform thickness materials having the claimed resistivity.

Art Unit: 2891

Claims 24-25, 27 are rejected under 35 U.S.C. 102(b) as being anticipated by Mikoshiba – US 5,245,207.

Mikoshiba (especially col. 9, lines 12-28) discloses the claimed invention with materials having an electrical resistivity of several tens or several hundreds of  $\mu\Omega\cdot\text{cm}$  with uniform thickness.

Claims 28-29, 34 are rejected under 35 U.S.C. 102(b) as being anticipated by Hogan – US 6,156,647.

Hogan (especially abstract, col. 6, lines 6-41, Figs. 2, 3B) discloses the claimed invention with a copper barrier film with portions having non-columnar and columnar grains.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2-5, 7, 10-23, 30-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Sakamoto article and Hogan – US 6,156,647.

Sakamoto is applied as above and does not disclose the thickness nor using a second layer. Hogan (especially abstract, col. 6, lines 6-41, Figs. 2, 3B) teaches thicknesses of less than or equal to

Art Unit: 2891

10 nm, and thin films over a silicon dioxide surface with portions having non-columnar and columnar grains.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the thicknesses with non-columnar and columnar portions as taught by Hogan in Sakamoto's process to reduce spiking and defects.

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mikoshiba and Hu.

Mikoshiba is applied as above and does not disclose the atomic ratio. Hu (especially col. 6, line 42 to col. 10, line 57) teaches to vary the nitrogen content in a thin film.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to vary the atomic ratio and nitrogen content as taught by Hu in Mikoshiba's process to optimize the device resistivity required.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over (the Sakamoto article or Hu) and (Mikoshoba or Wolf).

(Sakamoto or Hu) is applied as above and does not disclose the resistivity of the thin film. Mikoshota (especially col. 9, lines 12-28) or Wolf (especially pages 190, 193) teaches a thin film with the claimed resistivity.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have a resistivity as claimed as being conventional for resistivity control.

Art Unit: 2891

Claim 32 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hogan and Hu.

Hogan is applied as above and does not give the specific ratios. Hu (especially col. 6, line 42 to col. 10, line 57) teaches a thin film with varying ratios.

It would have been obvious to one of ordinary skill in the art at the time the invention was to vary the ratio as taught by Hu in Hogan's process to adjust device resistivity.

Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sakamoto and Hogan as applied to claims 2-5, 7, 10-23, 30-31 above, and further in view of (Mikoshiba or Wolf).

Sakamoto and Hogan are applied as above and do not disclose the resistivity. Mikoshiba (especially col. 9, lines 12-28) or Wolf (especially pages 190, 193) teaches a thin film with the claimed resistivity.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have a resistivity as claimed as being conventional for resistivity control.

Claims 42-44, 60-62, 64, 73-76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hu and Hogan.

Hu is applied as above and does not disclose using copper nor the specifics of the forming atmosphere. Hogan (especially abstract, col. 6, lines 6-41, Figs. 2, 3B) teaches using copper and Ar/N<sub>2</sub> plasma to form a uniform thick thin film.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use copper and the atmosphere and non-columnar and columnar grain structures as taught by Hogan in Hu's process to reduce spiking and defects.

Claims 45-59, 63, 65-72 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hogan and (Mikoshiba or Wolf).

Hogan is applied as above and does not disclose the resistivity of the thin film. Mikoshiba (especially col. 9, lines 12-28) or Wolf (especially pages 190, 193) teaches a thin film with the claimed resistivity.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have a resistivity as claimed as being conventional for resistivity control.

Claims 73-76 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Sakamoto article and Hogan.

Sakamoto (article) discloses substantially the claimed invention by forming a layer of Ti and Zr having non-columnar grain structure. Sakamoto does not disclose to form a second layer comprising columnar grain structure. Hogan (especially abstract, col. 6, lines 6-41, Figs. 2, 3B) teaches to form a second layer over a silicon dioxide surface with portions having non-columnar and columnar grains.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the thicknesses with non-columnar and columnar portions as taught by Hogan in Sakamoto's process to reduce spiking and defects. The nitrogen content may reasonably be adjusted for attaining the required device resistivity and defect control.

Art Unit: 2891

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chandra Chaudhari whose telephone number is 571-272-1688. The examiner can normally be reached on Mon - Fri (9:00-5:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on 571-272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Chandra Chaudhari

Primary Examiner

Art Unit 2891



Chandra Chaudhari

September 28, 2007